STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

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MEMORANDUM TO: Project Engineers
Project Design Engineers

FROM: G. R. Perfetti, P. E.
State Bridge Design Engineer

DATE: October 19, 2006

SUBJECT: COMPUTING NON-COMPOSITE DEAD LOAD DEFLECTIONS ON STEEL BRIDGES

Over the past decade, NCDOT has increasingly experienced construction issues related to the inaccuracy of the predicted girder deflections of steel bridges. Typically, girders are analyzed and designed using a single girder analysis approach, where the girder is assumed to be deflecting independently of the other girders in the cross-section. This is often referred to as the single girder line (SGL) analysis method. This approach often leads to predicted girder deflections that are significantly different from those observed in the field.

To address this issue NCDOT funded a research project at North Carolina State University titled *Development of a Simplified Procedure to Predict Dead Load Deflections of Skewed and Non-skewed Steel Plate Girder*. The research concluded the following:

- Field measured deflections correlate poorly with SGL predicted values.
- Intermediate diaphragm stiffness has little effect on dead load deflections.
- The following properties have a significant effect on deflections:
  - Stiffness provided by SIP metal deck forms.
  - Skew.
  - The girder spacing to span length ratio.
  - The ratio of the dead load of the exterior girder to the dead load of the adjacent interior girder.

The research also recommended new design procedures for modifying SGL non-composite dead load deflections. These design procedures are the simplified procedure (SP), the Alternative Simplified procedure (ASP) and the Single Girder Line Straight Line (SGLSL) procedure. Effective immediately, use the new design procedures to modify the SGL predicted non-composite dead load deflections of steel bridges that meet all of the following criteria:

1. Span Length $\leq$ 250 feet
2. Girder Spacing $\leq$ 11.5 feet
3. $\frac{\text{Girder Spacing}}{\text{Span}} \leq 0.08$

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Non-composite dead load deflections for bridges that do not meet the above criteria will require a more refined analysis that accounts for the stiffness of the entire structure, such as a 3-D finite element analysis.

A PowerPoint presentation providing a more detailed summary of the development and application of the SP, ASP, and SGLSL procedures and an Excel spreadsheet that utilizes these procedures are available via the Structure Design Unit's Homepage-Differential Deflection.

This policy supercedes the previous policy dated October 18, 2001. The Design Manual will be revised at a later date.

GRP/DAS/snj

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